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Modifiable Risk Factors For Osteoporosis Prevention In The College Population

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MODIFIABLE RISK FACTORS FOR OSTEOPOROSIS PREVENTION IN THE COLLEGE POPULATION

by

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Abstract

The purpose of this descriptive study was to identify the known modifiable risk factors for osteoporosis in the college population. Pender's Theory of Health Promotion served as the theoretical framework for this study. The research question was as follows: What preventive behaviors are college students participating in that will increase their risk of osteoporosis? Risk factors were measured using the Osteoporosis Lifestyle Survey, a tool with face validity. The sample population (N = 121) consisted of students, ages 17 to 30 years, who were attending a small southern university and who submitted the questionnaire. Data analysis was performed using descriptive statistics and content analysis for open-ended questions in the survey. Results from data analysis indicated that over 74% of the sample participated in factors that would decrease their chance of osteoporosis. They exercised (74.4%) and refrained from alcohol use (75%) and smoking (88.4%). The students (91.7%) rarely missed a menstrual cycle due to over-exercising and did not take prescription drugs (98.3%) that increased their

chance of osteoporosis. Calcium intake in this population was inadequate. Only 14.8% of the students consumed the recommended amount of calcium in their diet, and only 10% took calcium supplements. Multivitamin supplementation was reported by only 34.7% of the students. Conclusions from the data reveal that lack of dietary calcium intake was the most pressing problem in this population. Bone mineral density does not continue to accumulate significantly after age 30 years. Therefore, an urgent need to participate in all factors that build bone mass in the appropriate age span is essential. Future recommendations consist of exploring the modifiable risk factor of inadequate calcium intake for this population to see how to affect change in this area.

Acknowledgments

IT IS GOD
WHO ARMS ME WITH STRENGTH
AND
MAKES MY WAY PERFECT.
2 Sam. 22:33

Words cannot express how thankful I am to my husband, Andy, for his constant support and abiding love for me. His sacrifice, prayers, and endless encouragement, to do what I had to do, made this year possible. Thank you for sharing in this call.

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Chapter I

The Research Problem

Osteoporosis is a chronic disease that develops over a lifetime. Serious and debilitating, this disease affects more than 24 million Americans each year (Iqbal, 2000). Osteoporosis risk is determined by the degree to which a person is able to retain bone mass throughout his or her lifetime. This ability to maintain bone mass is influenced by certain risk factors, some of which are modifiable and some that are not. It is known that early participation in factors that prevent osteoporosis lead to a better outcome and a reduction of the devastating effects of the disease (National Institutes of Health Osteoporosis and Related Bone Diseases National Resource Center, 1997). The focus of this study was to identify modifiable osteoporosis risk factors in the adolescent and young adult.

Establishment of the Problem

Consequences of osteoporosis not only include devastating lifestyle changes from the aftermath of

fractures, but it also has a substantial financial impact. It is estimated that over $8 billion was spent annually on the treatment of osteoporosis related fractures in the United States alone (U.S. Preventive Services Task Force, 1996). Each year 430,000 Americans are hospitalized due to fractures related to osteoporosis (Nelson, 2000; National Osteoporosis Foundation, Osteoporosis and Related Bone Diseases National Resource Center, 1998). Hip fractures are the most common, with an estimated 15% of women over the age of 60 years sustaining a hip fracture sometime during their lifetime.

Changing modifiable risk factors is necessary to prevent future consequences of osteoporosis. "The more unavoidable risk factors you have, the more important it is to minimize the risks you can control" (Nelson, 2000, p. 64). Bone mass accumulates from infancy, peaking at approximately age 25 to 35 years (Leslie & St. Pierre, 1999). Between 30 years of age and menopause, bone mass remains fairly stable. Once menopause occurs women can lose from 2% to 3% of their bone mass per year for the first 5 years and continue throughout their lifetime at a slower rate (Iqbal, 2000). Factors enabling a high peak bone mass in the developmental years are essential. If the accumulation of bone mineral density is optimized prior to

menopause, the effects of the hormonal changes are significantly reduced (Jones-Watson, 1994).

The lifestyle factors that inhibit bone mineralization and increase the likelihood of reducing the severity of the disease consist of a diet high in calcium, physical activity, avoidance of cigarette smoking, excessive alcohol use, and some medications. The college student's future bone health depends in which of these lifestyle choices they participate. These decisions have lifelong consequences for the risk of osteoporosis.

During the period of skeletal growth, calcium intake appears to have a significant impact on bone mineral accumulation. The impact of osteoporosis can be reduced up to 50% through adequate nutrition (Lysen & Walker, 1997). The Recommended Daily Allowance (RDA) for calcium intake has been updated and is now called Dietary Reference Intakes (DRIs). The new recommendation for most adults is 1,000 mg of calcium a day with an increase to 1,200 mg over the age of 50 years. For persons ages 11 through 24 years, 1,200 to 1,500 mg of calcium a day, the equivalent of 4 to 5 servings of milk, yogurt, or cheese per day, is the standard recommended to reach peak bone density (National Dairy Council, 1999). Persons of all ages benefit from adequate calcium intake. The role of calcium in the body is important for proper metabolic functioning

of the cardiovascular, muscular, and neurologic systems as well as blood coagulation. Optimal calcium intake during adolescence and young adulthood directly influences a person's peak bone mass accumulation. Insufficient bone mass at the time of skeletal maturity and rapid bone loss after menopause are two of the most important risk factors for osteoporosis. Throughout life, storage and release of calcium from the bones are ongoing processes. Osteoporosis is the result of decreased bone-forming activity. The attainment of peak bone mass depends in part on calcium and vitamin D intake. The higher the peak bone mass prior to menopause is, the less chance there is of developing osteoporosis (Licata, 1999). Loss of calcium from the bones occurs in both men and women; however, it starts earlier and is more severe in women. The exact reason this occurs is unknown, but hormones, reduced intake, and absorption of both calcium and vitamin D, as well as a lack of exercise, contribute to this process (Sedlak, Doheny, & Estok, 2000). Without adequate calcium and vitamin D intake, the effects of changes in the skeletal system are apparent by a decrease in bone mineral density that results in fractures associated with osteoporosis.

The National Osteoporosis Foundation found that the risk for fracture can be accurately predicted by measuring hip bone mineral density and have recommended weight-

bearing exercises for bone growth, development, and continued bone strength throughout the life cycle. Exercise influences the rate of bone mineral density (Ernst, 1998; Maharam, Bauman, Kalman, Skolnik, & Perle, 1999). The onset of bone demineralization is around 30 years of age. Exercise helps with obtaining and then maintaining acquired bone mass (Dook, James, Henderson, & Price, 1997; Rutherford, 1999).

Sedentary individuals are identified as at risk for osteoporosis, so are overzealous female athletes. The number of female athletes has grown dramatically in the past 25 years due in part to the passage of Title IX legislation. "According to Title IX of the Educational Assistance Act, any college that accepts federal funding must provide equal opportunities for women and men to participate in athletic programs" (Hobart & Smucker, 2000, p. 3357). As a consequence of increased opportunity, increased participation has contributed to many health benefits. However, the risk of potential adverse health consequences has become evident in overzealous female athletes. "The female athlete triad syndrome is defined as the combination of disordered eating, amenorrhea and osteoporosis" (Hobart & Smucker, 2000, p. 3357). The osteoporotic component in the female athlete triad syndrome is recognized as having potentially irreversible

consequences. Inadequate bone mass formation and premature bone loss can result in an increased risk of fractures. "The accelerated bone loss is a result of estrogen deficiency and subsequent bone resorption" (West, 1998, p. 67). Significantly lower bone mineral density in multiple sites has been reported in female athletes with amenorrhea (Rencken, Chestnut, & Drinkwater, 1996). Because bone mass is gained by the age of 30 years, it is essential to identify athletes at risk for the triad syndrome at an early age. These athletes must continue to store bone while it is still possible to help prevent the long-term consequences associated with a low peak bone mass.

Alcohol use and smoking are common risk behaviors in adolescents and young adults. The U.S. Preventive Services Task Force (1996) reports that the prevalence of alcohol abuse and dependence among 18- to 29-year-olds in 1996 was 17% to 24% in men and 4% to 10% in women. These figures suggest a significant number of today's youth are at risk for co-morbidities, such as osteoporosis associated with alcohol consumption. The recommendation of no more than two drinks a day for men and one drink per day for non-pregnant women is the standard set by the preventive guide. Habits of alcohol use established in the college population can lead to unhealthy behaviors for a lifetime. Impaired calcium and vitamin D metabolism is related to

the consumption of more than two servings of alcohol a day (Sullivan & Sharts-Hopko, 2000). "Drinking more than seven alcoholic beverages per week is associated with increased risk of bone density and fractures" (Nelson, 2000, p. 63).

The risk of osteoporosis continues to rise with excessive alcohol use due to the added probability of poor nutrition and reduced dietary intake of calcium. Smoking, also, increases the risk of osteoporosis. The association between low bone mineral density and smoking is not well understood. The mechanism is unclear exactly how cigarette smoking affects bone calcium loss; however, studies have demonstrated that the deleterious effect on fracture healing and arthrodesis success is diminished in patients who smoke (Rosenthal, 1998). Reduced dietary calcium intake and changes in estrogen levels are discussed most often in the literature regarding smoking as a risk factor for osteoporosis.

Women who are smokers have lower estrogen levels and experience menopause earlier than nonsmokers (Iqbal, 2000). The effect of smoking on estrogen may be indirectly responsible for the resulting bone loss in postmenopausal women. It is well documented that estrogen inhibits bone resorption; however, the exact mechanism for this is unknown. The exact role of male sex hormones on

maintaining skeletal mass in men is also undetermined (Francis, 1999).

During adolescence and young adulthood people are receptive to health education as they begin the transition into greater independence and adopt adult patterns of behavior (Uphold & Graham, 1998). Adolescent choices lay the foundation for future health-promoting behaviors. Often nurse practitioners are the primary care provider for the college population. Health care encounters may be the only time these students consult with a health care professional during this stage in life. Emphasis should be on prevention and the development of lifestyle habits that will help them achieve optimal peak bone mass (Leslie & St. Pierre, 1999).

Nurse practitioners should be cognizant of the choices adolescents are making and be prepared to discuss modifiable risk factors. The National Institutes of Mental Health [NIMH] (1994) supports new descriptive research regarding the role of environmental factors and lifestyle choices, such as healthy eating habits, in this age group. The purpose of this research was to identify modifiable risk factors that put the college student at risk for osteoporosis. The results of this research will contribute to nursing knowledge regarding those risk factors. Development of disease prevention strategies based on

lifestyle choices in adolescents and young adults will assist the practitioner in decreasing the potential progression of osteoporosis.

Theoretical Framework

The researcher will utilize Pender's (1996) Health Promotion Model as the theoretical framework for this study. This model's focus is understanding the dynamics of behavior on health promotion. According to Pender (1996), the individual's characteristics and experiences and the perceptions that affect specific behaviors influence the eventual behavioral outcome. Realization that "individuals play a critical role in the determination of their own health status, since self-care represents the dominant mode of health care in our society" (Pender, 1996, p. 8) is an important concept when planning interventions that promote health.

Pender originally put forth the concept of promoting optimal health superseding disease prevention (Tillett, 1998). Tillett states that,

> The Health Promotion Model in its 1987 form identified cognitive perceptual factors in the individual that are modified by situational, personal, and interpersonal characteristics to result in the participation in health-promoting behaviors in the presence of a cue to action. (p. 531)

What individuals think and perceive can be modified when in the presence of something that prompts them to act. The Health Promotion Model involves individuals' perceptions that include the importance of health, perceived control over health, perceived self-efficacy, definition of health, perceived health status, perceived benefits of behaviors, and perceived barriers to health-promoting behaviors (Tillett, 1998). An update of Pender's original model expanded this concept in four ways to include the idea that prior related behaviors influence future behaviors. Activity-related affect consists of feelings associated with behaviors, and this idea affects future behaviors. Commitment to a plan of action involves both behavior and personal factors, along with interpersonal and situational influences. There is a component of the perception of benefits and barriers that occurs prior to an intended behavior. Some of these barriers are modifiable. Health-promoting behavior results when the individual takes responsibility for his or her own health as defined by that individual (Tillett, 1998).

Pender's most recent behavioral research is on exercise in adolescents and young adults. She states that "both the meanings and determinants of health behaviors are likely to differ across early, middle, and late adolescence and adulthood" (Pender, 2000) as differences

in behaviors at different stages in the life cycle. Research on the modifiable risk factors in the college population contributes to the knowledge of the health promotion behaviors of adolescents and young adults in relation to preventable behaviors for osteoporosis. Osteoporosis is a chronic disease that spans the individual's lifetime. The Health Promotion Model reinforces the idea that osteoporosis preventive behaviors should begin early in life in a positive and successful way to ensure lifelong compliance of health practices before barriers to performance alter the outcome.

Taggart and Connor (1995) found that younger participants, in their study of the college population, participated in more health-promoting behaviors than did older participants. The perception of barriers to health-promoting behaviors by the older participants led them to recommend that health-promoting behaviors begin early in life and continue throughout the life span. Pender also agrees that a person has a greater chance of long-term success with health-promoting behaviors before the influence of age and disease limits the ability to be successful in that behavior. The likelihood of resistance to barriers and continued compliance is higher if begun early (Tillett, 1998).

According to Pender (2000), nursing should promote preventative health behaviors by identifying and promoting lifestyle measures on a practical and individual basis. As a profession, the advanced nurse practitioner is in an ideal position to "take the leadership in incorporating the findings of research about health promotion into clinical practice and into community partnerships and programs" (Pender, 2000).

Assumptions

The assumptions underlying this study are as follows:

1. Osteoporosis is a severe and sometimes debilitating disease, the severity of which can be altered.

2. Lifestyle can modify the risk of osteoporosis.

3. Bone mass does not peak until age 30, therefore providing ample time for interventions enhancing maximum bone mass.

Statement of the Problem

The individual modifiable risk factors that the college population is actually participating in are not well documented. Sedlak, Doheny, and Jones (1998) stated, "The majority of osteoporosis research findings have been on postmenopausal women with little focus on prevention research for young women" (p. 53). There is a paucity of

information regarding college population participation in the identified modifiable risk factors for osteoporosis prevention. Nutrition, medication, and hormonal influences that impact osteoporosis have not been documented in the college-age population; however, exercise has been evaluated in this population. The effects of excessive exercise on college-age women and their bone mineral density are well known. Hobart and Smucker (2000) identified extensive literature in their review of the female athlete triad. A combination of disordered eating, amenorrhea, and osteoporosis was present in the female athlete triad. Alcohol use and cigarette smoking have often been the topics of research with college students because of other safety and health issues; however, the association to prevention activities for osteoporosis in this population has not been well-documented (U.S. Preventive Services Task Force, 1996). Jones-Watson (1994) recommended that nurses "identify more definitive sets of indicators that would facilitate the comparison of the health status of different populations" (p. 33). Conducting descriptive assessments of the college population will produce a basis for future educational interventions that can target specific modifiable risk behaviors at an early age.

Research Question

The researcher examined the following question in this study: What are the modifiable risk factors in the college population that contribute to an increased risk for osteoporosis?

Definition of Terms

For the purpose of this study, the following terms are defined:

College population: Theoretical: "the age group in which optimal bone development is likely to occur and certain lifestyle behaviors are reinforced" (Leslie & St. Pierre, 1999, p. 67). Operational: adolescents and young adults, age 18 to 30 years, in whom peak bone mass is developing and who attend an institution of higher learning.

Osteoporosis: Theoretical: a disease that is a systemic "metabolic disorder that causes demineralization of bone and reduction in bone mass" (Sedlak et al., 1998, p. 53). Operational: the resorption of histologically normal bone at an accelerated rate and not a normal process of aging.

Modifiable risk factors for osteoporosis: Theoretical: "Certain favors are linked to the development of osteoporosis or contribute to an individual's

likelihood of developing the disease" (National Institutes of Health [NIH], 1998). This includes lifestyle factors that can be changed or modified to reduce the risk of osteoporosis. Operational: known elements that contribute to increasing the chance of developing osteoporosis as determined by the Osteoporosis Lifestyle Survey.

Chapter II

Review of Literature

A review of the literature revealed several studies that explored modifiable and non-modifiable risk factors in certain population groups at risk for osteoporosis. Few studies, however, sought to identify what the college-age population is doing to prevent future risks of osteoporosis. The focus of research was on specific risk factors, such as exercise, smoking, and dietary intake of calcium. Most of the research reviewed centered on women; only a few studies evaluated men. Children were the subject of some studies observing the amount of dietary calcium and participation in physical exercise as they relate to the development of peak bone mass.

In 1992 osteoporosis research expanded to include the female athlete and the unique part that osteoporosis plays in the female triad athlete syndrome. Research regarding the knowledge and beliefs of osteoporosis risk factors were primarily conducted on women, although occasional studies included men, as specific risk factors were better understood. New pharmaceutical options to treat

osteoporosis and the advances in available diagnostic tools resulted in the majority of the research. Predominantly these studies centered on identification and treatment of the disease in post-menopausal women. The current study will add to the literature on the younger age group.

Lysen and Walker (1997) explored adolescents' participation in modifiable and non-modifiable risk factors for osteoporosis in eighth-grade students. The study sought to compare the incidence of the risk factors in male and female students. The rate of participation in the modifiable risk factors of calcium intake, physical activity, sodium intake, body mass index, smoking status, and alcohol intake was evaluated. Specific non-modifiable risk factors were examined including gender, ethnic heritage, and family history. The researchers surmised that students with a combination of modifiable and non-modifiable risk factors were at an increased risk of compromising peak bone mass. The descriptive design of this study was to identify those adolescents who were at the greatest risk for developing osteoporosis in the future because of a lack of optimizing their peak bone mass during adolescence.

Lysen and Walker (1997) stated that the rate of osteoporosis cases are growing in numbers because

adolescents are not participating in the correct modifiable factors that can reduce their risk of developing the disease. The researchers examined what the modifiable and non-modifiable risk factors were for osteoporosis in adolescents. The researchers explained that "Each person's bone is genetically controlled, with approximately 80% of total bone mass attributed to genetic predetermination. This percentage includes gender, ethnic heritage, basic body type, and family history of disease" (Lysen & Walker, 1997, p. 317). Lysen and Walker justified that "optimizing peak bone mass and maintaining skeletal mass throughout adulthood must be the primary focus of prevention" (p. 317).

The descriptive design of the study allowed detailed information to be obtained and gender comparisons to be examined. The sample consisted of 138 students in the eighth grade at two schools in midwestern United States. The mean age was 14.3 years, 40.6% of the sample were males, and 59.4% were females.

Two instruments were developed by the researchers for the study, one of which was modified from an existing instrument. The first instrument consisted of two parts and had a Spearman-Brown correlation coefficient of $\underline{r}$ = .9723 for the parent part and $\underline{r}$ = .9971 for the student part. The first part of the questionnaire was sent home,

and the parents completed items regarding personal health history and demographic information regarding the student. When this portion was returned to the teacher, the student completed the second portion, assessing personal health habits and demographic information.

The second instrument was a food frequency questionnaire modified to include sodium intake and reflective of the eating habits of midwestern students. The reliability coefficient of this tool was $\underline{r} = .6789$. This questionnaire estimated average daily calcium and sodium intake. The students were instructed on the estimation of serving sizes and on how to correctly report food consumption on either a daily, weekly, or monthly basis. Evaluations to determine body mass index by measuring the height and weight of each student were performed.

The frequency and descriptive statistics on all modifiable and non-modifiable risk factors were analyzed. Total and combinations of risk factors were evaluated. Chi-square analysis was performed between gender and each risk factor, with an alpha level set at .05 for all tests performed.

All students had some risk factors, 10% of the sample had six or more risk factors, while 26% of the sample had three or fewer. Out of a possible nine total risk factors

the mean was 4.1. Non-modifiable risk factors were high in this population, 41.3% had a family history of osteoporosis, 59.4% were female, and 85.5% of ethnic heritage increased their risk of disease. Modifiable risk factors were ranked with high-sodium intake 68.1%, followed by 42.8% qualifying as underweight for height (body mass index). Calcium intake was below the National Institutes of Health's recommended daily optimal intake level for adolescents of 1,500 mg per day by 36.2%, while the study demonstrated that 79% did consume at least 1,200 mg, the RDA standard. Physical activity was reported to be inadequate in only 21.7% of the students while alcohol consumption was reported at 20.3%. Smoking was reported by 13.8% of the students.

The gender comparison with each modifiable risk factor revealed that 53.6% ($p = .034$) of males were underweight for height, and 78.6% ($p = .029$) consumed excessive sodium when compared with females. Males had a significantly higher calcium intake when compared with females for both levels, 1,200 mg ($p = .043$) and 1,500 mg ($p = .023$).

The researchers recommended identification of those students who had an increased risk for osteoporosis because of non-modifiable risk factors. This increased risk indicates the importance of beginning intervention

during adolescence to increase peak bone mass because optimum protection can potentially be gained even with a genetic predisposition for osteoporosis. The adolescent years are when peak bone mass is forming and lifelong protection can occur.

In this study adolescents had a higher than average calcium intake at the RDA daily level of 1,200 mg but still fell below the National Institutes of Health recommended daily intake of 1,500 mg. Low calcium intake among the females in this study was attributed to differences in food volume and caloric intake when compared with males. The researchers explained that this may also be related to adolescent girls' perception that dairy products are a high-fat food.

Physical activity levels in the sample population were higher than the national average. Physical activity levels are related to increases in skeletal mass. Excessive sodium intake was of concern to the researchers because of a positive correlation between daily calcium excretion and daily sodium intake reported in their review of the literature. Low body mass index in the sample highlighted concern regarding possible eating disorders, many of which are associated with amenorrhea and subsequent osteoporosis.

Lysen and Walker (1997) have "recommended further research using a DEXA analysis for bone density levels to determine if risk factor totals coincided with bone density levels" (p. 321). This study indicated that adolescents in this sample were deficient in all the modifiable risk factors. The participants had a significantly better calcium intake than was expected. They also had physical activity levels higher than the national average. Smoking and alcohol consumption were less than the national average. Body mass index was low, and sodium intake was high in males.

Overall this study demonstrated that the majority of adolescents in the sample were participating in lifestyle choices that were good for bone health. Gender comparisons did illustrate that males have specific risk factors that need to be addressed, such as high-sodium intake and low body mass index. The researchers recommended that females should increase their calcium intake.

The average child in the study by Lysen and Walker (1997) had 2.3 modifiable risk factors. Those areas should be the starting points at which education and intervention should proceed. The mean age of 14.3 years was significant as a comparison to whether the older adolescent in the current study had the same risk factors.

Teegarden, Lyle, Proulx, Johnston, and Weaver (1999) conducted a study to assess if childhood and adolescent exposure to calcium had any effect on the continued consumption of milk and its long-term effect on bone mineral density. These assessments included examining the relationship between previous milk intake, current calcium intake, and current bone mineral density in women. The authors hypothesized that higher milk intake during adolescence influences peak bone mass in the spine, radius, and total body measurements and that spinal bone mineral content was influenced by current calcium intake.

A cross-sectional, nonexperimental study included an interview portion as well as empirical data collection. An attempt to eliminate extraneous variables was achieved by limiting the age of the sample and various influencing factors. The sample target consisted of white women between the ages of 18 and 31 years. The sample did not include persons who had exercised more than 2 hours a week in the year prior to the study or persons who had a history of hypertension, heart disease, or diabetes. Two other exclusions were (a) people with irregular menses and (b) chronic intake of medications that interferes with calcium metabolism.

Data collection began with an interview by two trained nutritionists assessing the participants' current

calcium intake. Previous milk intake during two stages of life, early childhood to age 12 years and age 13 to 19 years or adolescence, was evaluated by dietary recall. The responses were divided into three categories: infrequently or never, sometimes, and at every or almost every meal. Teegarden et al. (1999) stated that the use of recall was reliable for the adolescent stage due to the participants' relatively close age to that stage. The recall of childhood intake, although not as reliable, correlated well with the adolescent intakes, $r = 0.66$.

Empirical data were obtained, evaluating height, weight, bone mineral density, and bone mineral content at several body sites. The bone mineral density and bone mineral content were measured in both trabecular as well as cortical bone using dual-energy x-ray absorptiometry.

Statistical analysis methods consisted of means, standard deviations, and correlations for all variables. Recall data were evaluated using multivariate and univariate regression methods. The authors adjusted for weight because it is a strong predictor of bone mass.

Teegarden et al. (1999) discovered the frequency of milk intake diminished between childhood and adolescence, $r = 0.66$, $p < .0001$, and a positive correlation existed between the two ages as well as with current calcium intake, $r = 0.26$ and $r = 0.33$, respectively, $p < .0001$.

The researchers determined early milk intake does influence higher intake of calcium in young adults.

Teegarden et al. (1999) concluded the habit of drinking milk in childhood and adolescence continued when established early in life. Higher milk intake during adolescence did influence peak bone mass at several sites, but only continued calcium intake had any effect on the spine's bone mineral content. The authors determined an important finding that the spine has a high metabolic turnover rate; therefore, many fractures occur in the vertebrae later in life. Increasing milk intake during peak bone mass development is a primary recommendation of Teegarden et al. The researchers also reported that continuation of calcium consumption had a direct effect on risk reduction for osteoporosis.

The sample age for this study on milk intake and bone density is essentially the same as the sample in the current study on modifiable risk factors. The researchers supported the need to assess individuals between the ages of 18 and 30 years for their compliance with dietary recommendations. Another significant point was that early dietary habits had an influence on the continuation of those habits throughout young adulthood. This observation supported the evaluation of modifiable risk factors in the current study. Risk factor identification should result in

the establishment of intervention at an early age so the risk is minimized before the lifestyle of the college population becomes habit.

Assessing calcium as a predictor of peak bone mass and examining how self-selected exercises among adolescents affected bone mineral density was the purpose of the study by Lloyd et al. (2000). A longitudinal study involving 81 healthy premeanarchal females was conducted for 6 years. Approximate age at entry was 12 years, and they were seen every 6 months until age 16, then once a year thereafter. Three-day diet records were completed at each visit in the 6 years. Each participant's bone mineral density and other body composition measurements were assessed at consistent intervals. Yearly fitness measurements for aerobic power, strength, and flexibility were collected. A sports-exercise questionnaire was used in this study which listed 28 school-based, outside-of-school, and individual activities. The participant recorded the activity and frequency, in which she participated. Activities assessed, for example, were basketball, soccer, aerobic classes, swimming, running, martial arts, and tennis.

Statistical analyses were descriptive, and Pearson's correlation coefficients were calculated to investigate the relationships between variables. The sports-exercise

score, r = .42, p = .0001, evaluated from the questionnaires used at regular intervals during the 6-year study demonstrated a significant positive correlation with hip bone mineral density at age 18 years. Body weight, r = .40, p = .0002, and wall-sit exercise score, r= .28, p = .01, were positively correlated with the hip bone mineral density also. Daily nutrient and food group consumption did not correlate with hip bone mineral density or total body bone mineral gain. Specifically, there was no relationship with hip bone mineral density and daily calcium intake average over the 6 years, r = .10, p = .36.

Although this study did not demonstrate a correlation of calcium intake to hip bone mineral density, other studies have identified maximum calcium intake as an important nutritional component of optimum bone mass formation. The longitudinal study did identify the fact that the participants consumed 919 mg of calcium a day at age 12 and increased their intake to 926 mg of calcium a day at age 18. Although there was a modest increase, the overall calcium intake was still under the RDA recommended 1,200-mg per day.

The researchers concluded that, "An increase of .05 grams per centimeter of hip bone density was projected to represent a 50% reduction in osteoporotic fracture risk" (p. 5). This study was able to identify sedentary

teenagers from those who participate in some form of activity on a daily basis based on their hip bone mineral density. This outcome illustrates that exercise is important in prevention of osteoporosis. This study supports the fact that exercise can make a visible difference in bone mineral density. Lack of exercise is a risk factor for decreased optimal bone mass; therefore, identification of sedentary persons that are building their peak bone mass is important.

An important aspect that affects the success of an appropriate exercise program for the prevention of osteoporosis is the belief that exercise can make a difference in personal health. An understanding of the personal risk of osteoporosis is ideal but not necessary to achieve a reduction in osteoporosis risk. If an effective regime is in place for overall health, then the goal has been accomplished.

Taggart and Connor (1995) conducted a study to determine why some people participate in self-care and others do not participate. The researchers focused on exercise habits related to the belief that osteoporosis is a debilitating disease and can be prevented by exercising. According to these authors, osteoporosis is a serious disease that affects millions of people. Although factors that can be modified to prevent osteoporosis have been

identified, research is still deficient in determining factors that influence women to participate in a preventative lifestyle.

The researchers stated that osteoporosis is a major cause of bone fractures in the United States. Hip fractures, resulting in death and increasing healthcare costs, stimulated the authors to look at this subject from a perceptual and behavioral viewpoint. Choosing to focus on one modifiable risk factor, exercise, allowed them to study knowledge of osteoporosis and beliefs about the preventative nature of exercise as it relates to osteoporosis.

A descriptive, correlational design was used to determine osteoporosis beliefs, knowledge, and exercise habits. The variables included in the study were susceptibility to acquiring the disease, beliefs about the seriousness of the perceived personal threat of osteoporosis, and exercise barriers or factors that prevent exercising. Taggart and Connor (1995) hypothesized that there would be a relationship between the frequency of exercise and the knowledge about the seriousness of osteoporosis, the beliefs about the benefits of exercise, and the acknowledged impediments to exercise. The conceptual framework for this study was a modified Health Belief Model.

The convenience sample consisted of 113 college students who attended a basic health course that did not include teaching about osteoporosis. All students were female, and a large portion were nontraditional college women with a mean age of 25.06 years.

An instrument was designed that incorporated demographic information and questions that assessed belief as well as knowledge about the subject. The Osteoporosis Health Belief Model Scale, which was developed and validated by researchers at Grand Valley State University in Allendale, MI, was administered to test health beliefs. Other portions of the survey were developed through information gleaned from a review of literature. Using a tape measure, a wrist measurement was done to help establish non-modifiable risk information. A self-report regarding the frequency and type of exercise habits was included. Questions that measured health beliefs of osteoporosis were included, such as susceptibility to the disease, seriousness of the disease itself, exercise barriers and benefits, and health promotion based on knowledge and beliefs. "The test was designed to identify participant's knowledge about risk factors for osteoporosis, potential consequences of the disease, and benefits of exercise as a preventive measure" (Taggart & Connor, 1995, p. 13).

Data were analyzed using the Pearson's r. The researchers determined that knowledge and beliefs of osteoporosis were not significantly correlated with the frequency of exercise, but the benefits of exercise strongly correlated to the knowledge about osteoporosis, r = .25, p = .01. Belief in the seriousness of the disease was related to the women's perception of their own risk of acquiring the disease, r = .24, p = .05. Age emerged as the most significant demographic variable between health motivation, r = .9, p = .05, and knowledge, r = .19, p = .04. Barriers to exercise were more prevalent in the older participant, r = .94, p = .001.

The researchers indicated that the perception of osteoporosis risk did not motivate participants to exercise; other factors influenced participation in this health prevention lifestyle. Reasons were "increased muscle strength, weight control, improved appearance, and enhanced cardiovascular function" (p. 14). The younger the participant, the more frequent the exercise. The older participants had more barriers to exercise and, therefore, participated less frequently, although their knowledge and their beliefs of osteoporosis risks and personal susceptibility were higher than the younger student. "The specific barriers to exercise confirmed by the Osteoporosis Health Belief Scale scores included a lack of

social support, difficulty in starting a new habit, and interference with routine" (Taggart & Connor, 1995, p. 14).

Taggart and Connor (1995) did not find any significant relationships between exercise habits and health beliefs and no correlation between exercise habits, health beliefs, and knowledge about osteoporosis. But they did determine that the relationship of exercise habits and the motivation to participate in exercise was related to age, general health-promoting beliefs, and the presence or absence of specific barriers to exercising. Lastly, knowledge and understanding of the benefits of exercise and the personal susceptibility to osteoporosis were significantly related in this sample.

The perceived barriers to exercise and the resulting lack of physical activity by older women in the study have led the authors to recommend research that considers ways to assist older persons in eliminating barriers to health-promoting lifestyle changes. They also recommended evaluation and development of educational interventions that include the concept of personal susceptibility to osteoporosis, as well as increasing the knowledge and understanding of the benefits of exercise, as it relates to osteoporosis prevention. This intervention should be presented at a younger age due to the complicated

variables that affect women today. Lifestyle habits are formed early and are difficult to change.

This research is germane to the current researcher's study because exercise habits of a similar sample population were evaluated. Building on Taggart and Connor's findings, a description of the modifiable risk factor of exercise as well as other risks in this population were identified.

The majority of the research has been conducted on females, but researchers indicate that the problem of osteoporosis in men is now being recognized as a public health issue (Iqbal, 2000). Men are also at risk for losing bone mass in later life usually due to hypogonadism or a decline in levels of free, biologically active testosterone. Other risk factors for osteoporosis in the aging male are a decrease in physical activity, tobacco and alcohol consumption, and a lifetime of low-calcium consumption (Francis, 1999). All men past age 65 should consider themselves at risk for osteoporosis (Nelson, 2000). The modifiable risk factors for men are the same as for women except estrogen hormone-related issues.

Sedlak, Doheny, and Estok (2000) conducted a study to assess the health beliefs and knowledge of osteoporosis in older men. The study considered the confidence level as well as the actual performance of certain osteoporosis

preventive behaviors. The problems explored in this study were the knowledge of osteoporosis, the perception of risk for developing osteoporosis, activity level, and perceived ability to participate in osteoporosis prevention. The specific questions asked were as follows:

1. What is the level of knowledge of osteoporosis held by men $\geq$ 65 years of age?

2. What is the level of perceived susceptibility to osteoporosis held by men $\geq$ 65 years of age?

3. What is the perceived level of confidence related to the performance of osteoporosis prevention behaviors held by men $\geq$ 65 years of age?

Variables evaluated were knowledge of osteoporosis, modifiable risk factors, and behavioral issues that helped or hampered participation in the modification of the identified behaviors. Reduction in dietary calcium, lack of weight-bearing exercises, smoking, and excessive alcohol use were the modifiable risk factors identified. Using Bandura's Health Belief Model, five variables that affected health beliefs and behaviors were evaluated. Susceptibility or the perceived risk of developing osteoporosis was considered. The belief that specific behaviors can impact a disease was referred to as benefits. Barriers or the recognition of obstacles to health-promoting activities and health motivation or the

readiness to participate in general health-promoting actions were also assessed.

This theory-based descriptive study consisted of a homogeneous sample of Caucasian men, ages 65 to 89 years. Demographic information included marital status, education, height, and weight. Participants attended different community centers in Ohio where they were given a three-part questionnaire that took approximately 30 minutes to complete. They were instructed to return the questionnaires by mail in the stamped, self-addressed envelope provided. The participation rate was 86.3% (or 138 men) after incomplete and questionnaires not returned were eliminated.

Four instruments were combined to ascertain the level of knowledge, confidence, and osteoporosis behaviors. The tools used were the Osteoporosis Knowledge Test, the Osteoporosis Health Belief Scale, the Osteoporosis Self-Efficacy Scale, and the Osteoporosis Preventing Behaviors Survey. The 22-item Osteoporosis Knowledge Test was modified for this study to eliminate questions related to female hormone status. Using the Osteoporosis Knowledge Test, the relationship of knowledge to activity levels, exercise, and dietary intake of calcium to osteoporosis was evaluated. Health beliefs were assessed using the Osteoporosis Health Belief Scale consisting of 42 items.

These items measured beliefs about susceptibility, seriousness, benefits of exercise, benefits of calcium intake, barriers to exercise, barriers to calcium intake, and health motivation. The third portion of the questionnaire contained the Osteoporosis Self-Efficacy Scale which is a 12-item visual analog. This scale asked subjects to rate their confidence involving calcium intake and exercise in relation to osteoporosis-preventing activities. The fourth component in this study, the Osteoporosis Preventing Behaviors Survey, evaluated dietary intake of calcium, activities, exercise, smoking, and alcohol use. Demographics in the Osteoporosis Preventing Behaviors Survey included a family history of osteoporosis and income.

Data analysis was performed on each portion of the tool and combined using a relational data base management system. "Frequency distributions, measures of central tendency and variability were determined, and confidence levels were established for study variable means" (Sedlak, Doheny, & Estok, 2000, p. 44). Relationships between study variables and specific demographics were examined.

The Osteoporosis Knowledge Test used a standard school grading scale to analyze the level of knowledge. The majority of the men failed the knowledge test. The scores ranged from 5 to 91 ($\underline{M}$ = 50, $\underline{SD}$ = 18.83). The

Osteoporosis Health Belief Scale was measured by six Likert items to test the susceptibility score. Scores ranged from 1 (strongly disagree) to 4.5 (strongly agree) (*M* = 2.24, *SD* = 64). The Osteoporosis Self-Efficacy Scale measured the perceived level of confidence related to the performance of prevention behaviors. Exercise was measured on a 10-point scale, 0 being the least confident and 10 being very confident. The mean exercise score was 66.93 (*SD* = 25.13). The population was within 64.79 to 69.07 range. Calcium was measured on the same scale. The mean score was 67.68 and ranged from 65.58 to 69.78 (*SD* = 24.64).

Preventing behaviors were reported using frequency distributions. Calcium intake was determined to have a mean of 542.57 with a range from 0 to 2225 (*SD* = 393.93). Only 1.4% of the men reported taking the recommended daily dose of calcium (1,500 mg). One tenth of the men reported 10 drinks or more during a week. Over one third of the men engaged in weight-bearing exercises less than two times a week, and 10% participated in weight-bearing activities six or more times a week. Ninety-eight percent of the men did not smoke.

These data indicated that men in this study had a very low knowledge level regarding osteoporosis. The perceived susceptibility to developing osteoporosis

indicates that most men did not perceive a risk of developing the disease. Sixty-seven percent of the men were confident in their ability to perform exercises and comply with the daily-recommended amount of calcium intake although actual compliance with osteoporosis preventing behaviors was below daily recommendations for exercise and calcium intake. Alcohol use and smoking were low in this sample.

The researchers suggested that osteoporosis education for men and the inclusion of men in osteoporosis healthcare initiatives are a necessary focus. Recommendations that men should be included in further osteoporosis research were made by Sedlak, Doheny, and Estok (2000). The findings illustrated that men are at risk and are unaware of their susceptibility to osteoporosis.

The current study on identifying modifiable risk factors for osteoporosis in the college population will include men. Osteoporosis is a chronic disease that spans a lifetime. The modifiable risk factors that were studied, calcium intake, exercise, alcohol, and smoking, are some of the same factors identified in the current study. A correlation between what men age $\geq$ 65 years and college men would be of interest to plan future interventions.

Morabia, Bernstein, and Antonini (2000) conducted a study of women smokers. The researchers demonstrated that smoker's dietary calcium intake was substantially lower than nonsmokers. Smoking habits support a reduction in the ability to obtain peak bone mass during adolescence and young adulthood as well as contributing to bone resorption during the life cycle.

Smokers may have a low bioavailability of calcium either due to poor intestinal absorption of calcium or a low dietary intake. Morabia et al. (2000) conducted the study to determine the differences in dietary calcium and vitamin D intakes and cigarette use.

The problem focus of the research was to compare the dietary content between current smokers, previous smokers, former smokers, and persons who have never smoked. The definition of each is as follows: Current heavy smokers had > 20 cigarettes/day, current moderate smokers 1 to 19 cigarettes/day, ex-smokers cessation was 5 years or greater, and never smoked or < 100 cigarettes in their lifetime. The ex-smokers' results correlated well with never-smokers and were combined in the reporting of the results.

This study was a population-based survey that used a food frequency questionnaire with an interview component. It was conducted in Geneva, Switzerland, and consisted of

2,319 women who were residents in Geneva from 1993 through 1993. The ages ranged from 35 to 74 years. Random sampling by mail resulted in a 63% participation rate in the women's health survey. All participants answered a food frequency semi-quantitative questionnaire at home on a self-directed basis. It assessed the usual diet during 4 weeks previous to an interview that was conducted in a mobile unit 15 days following receipt of the questionnaire. Demographic, medical and familial history, sociodemographic factors, health and dietary habits, and smoking behaviors were evaluated. The smoking history was in calendar form and included number of cigarettes per day, the brand of cigarette used, and at what age the participant started smoking. Height and weight were obtained during the interview.

Major food sources of calcium were identified. These were yogurt, cheese, butter, cream, milk, and mineral water. Sources of vitamin D were cheese, margarine, eggs, fish, butter, and cream. The study excluded bread as a major source of calcium and vitamin D because in Switzerland bread is made with water not with milk, nor is it fortified with vitamin D as in the United States. All analyses were adjusted for age, body mass index, and education level.

Morabia et al. discovered that 53.1% of the 2,319 women never smoked and 24.1% were former smokers. The 22.8% who currently smoked tended to be younger, slimmer, and had completed a higher educational level. Overall daily calcium intake was lowest in heavy smokers (798 mg) and highest among never smokers (945 mg) and former smokers (934 mg) ($p < .0001$). Total vitamin D intake was lowest among smokers (1.92 ug) when compared to never smokers (2.39 ug).

The results of the study indicated that low dietary intake of calcium and vitamin D did correlate with cigarette use. Persons who had never smoked had an increased intake of calcium and vitamin D when compared to current smokers. The authors suggested that possibly smokers' dietary taste may be altered or they may be less health conscious. A previous study by one of the authors discovered that most women over 45 years of age do not consume 800 mg of calcium per day. The situation was even worse in smokers as demonstrated in this study. The authors stated that "from a biological and epidemiological perspective, the relation of smoking to osteoporosis can possibly be mediated or aggravated by a poorer dietary intake of calcium and vitamin D in smokers than in nonsmokers" (p. 688).

The significance this study demonstrated that bone health can be influenced negatively by smoking, therefore, indicating that smoking contributes to osteoporosis risk. Decreased calcium intake and the resulting decrease in bone mineral density contribute to osteoporosis. The researchers concluded that individuals should avoid smoking, especially while bone mass is being formed in order to gain the optimum peak bone mineralization possible. Determination of the portion of young women in the college population who are smoking can result in better education regarding the risks they are incurring for osteoporosis. If women continue to smoke the advice is to increase their intake of calcium and vitamin D enriched foods to help thwart the inevitable results of bone loss. Further studies should be performed to determine if reduced calcium dietary intake is the only negative result for osteoporosis risk in the smoker or is there interference in intestinal absorption of calcium that contributes to the process.

Summary

The sample populations in the review of the literature were not the same, but the information and results of the research apply to persons throughout their life span. Osteoporosis is not a disease of old age but

has roots in the lifestyle choices made, even as young children. Consumption of dietary calcium is essential for bone mineral density, and the literature supports the fat that the general population fails to meet the RDA standard for this mineral.

Modifiable risk factors for osteoporosis and the effect of beliefs and knowledge regarding the disease were evaluated in different sample populations. Personal susceptibility regarding the disease and the effect on the participation in risk factors were studied. Only one study, Lysen and Walker (1997), reported that the subjects consumed the RDA standard for calcium consumption. In that study, the slightly higher NIH standard was not met. This literature review reveals a consistent lack of adequate calcium consumption in men, women, and children.

The literature revealed a close correlation between optimal peak bone mass and adequate calcium intake. Other risk factors that may influence the severity of osteoporosis were evaluated. These included smoking, alcohol use, and exercise. Lack of exercise affected bone mineral density. Alcohol abuse has been identified as a potential risk factor, and the frequency of use was explored as a factor in men and teens. Smoking and low calcium intake were suspected to affect optimal peak bone mass in the study conducted by Morabia et al. (2000).

Knowledge and perceived risk of the disease were examined in two studies. Understanding susceptibility to osteoporosis and having knowledge of the disease altered participation in preventive modifiable risk behaviors. This aspect of research cannot be ignored when attempting to make lifestyle changes as a result of identifying modifiable risk factors. The literature is expansive on different aspects of osteoporosis, risk factor identification, and treatment. The current study will add to the knowledge base in understanding participation in known modifiable risk factors of a specific population.

Chapter III

The Method

Design of the Study

This study was a nonexperimental, descriptive design. The design was chosen in order to provide a clear description of modifiable risk factors that the college population participates in that may increase their risk for developing osteoporosis. The factors were not manipulated but provide a basis for future research and a focus for future educational intervention. Selected risk factors of osteoporosis have been identified and are considered to be the variables of interest, i.e., calcium intake, alcohol use, exercise, amenorrhea due to excessive exercise, smoking, and certain medications. Variables of interest there were qualitatively evaluated were perception of risk and knowledge of osteoporosis. The survey assessed the variables that are relevant to the college population and are amenable to intervention.

Setting, Population, and Sample

The study was conducted at a small university in southern United States. The target population consisted of individuals who are in the process of developing peak bone

mass who attend the university. All individuals, male and female, who submitted a completed survey and who were between the ages of 17 and 30 years were included in the sample. The target sample was 121.

Instrumentation

A researcher-designed survey tool based on a review of the literature was used. A small pilot study was conducted 3 months prior to data collection. The participants in the pilot study were a convenience sample of 13 individuals in the sample age range who came to a private physician's office for health care. Clarification of wording and ease of survey use were based on the pilot sample feedback. No data from the pilot study were calculated into the final study results. The researcher assumes the survey to have face validity within the confines of the study.

The Osteoporosis Lifestyle Survey (see Appendix A) was used. It consisted of 14 questions requiring a combination of multiple-choice answers and 3 with open-ended responses. Modifiable risk factors for osteoporosis include exercise activities, nutrition, medication use, and health behaviors that influence the development of osteoporosis. Questions 1, 2, and 3 were to assess the demographics of age, gender, and race. Questions 4, 5, 9, and 10 addressed nutritional status. Question 6 evaluated exercise regularity and the type of exercise performed

while Question 12 looked at the student's perception of their exercise activity. Hormonal changes due to excessive exercise was examined in Question 7. Behavior activities of smoking and medication use were questioned in Questions 8 and 11, respectively. A portion of Questions 6 and 13 sought students' reasons for not exercising and beliefs regarding their risk of osteoporosis. The final question, Question 14, was an open-ended question inquiring about personal knowledge of osteoporosis.

Data Collection Procedure

Following approval of the Committee on the Use of Human Subjects in Experimentation (see Appendix B), the Osteoporosis Lifestyle Survey (OLS) was distributed in several areas of the university. The researcher did not personally hand out the surveys but requested different students to dispense the surveys in each area to avoid researcher bias. The places of distribution were a student health fair, two social club meetings, and the university library circulation desk. The surveys were given to each participant with the instructions to fill out the survey and return it to the box provided. They were also instructed not to include their name on the survey. Privacy of the completed survey was guaranteed with no identifying factors present on the survey. The

researcher's absence at the time of distribution further insured the anonymity of the participants. The information gathered during the study was kept confidential. All the surveys were destroyed after the data analysis was complete.

Data Analysis

Data were analyzed using descriptive statistics. Central tendency, measures of variability, and frequency distribution for the variables were evaluated. Common themes for qualitative responses in Question 14 and part of Questions 6 and 13 were prepared. The aim of this study was to describe modifiable factors the college population is participating that will contribute to an increased risk of osteoporosis.

Chapter IV

The Findings

The purpose of this study was to identify the modifiable risk factors for osteoporosis in the college population. The design of the study was a nonexperimental, descriptive study. This chapter describes the sample and analysis of the data identified as modifiable risk factors.

Description of the Sample

Random convenience sampling for data collection was obtained from the college population. The participants attended a small public university in southern United States. The sampling took place at several different locations on the university campus: a health fair, two social club meetings, and the campus library circulation desk. The final sample consisted of 121 participants.

Demographic data were collected for all the participants and consisted of age, race, and gender. The students ranged in age from 17 to 30 years. The mean age was 21.7 years (*SD* = 2.73). Caucasian students were the largest racial group at 64.5% (*n* = 78). African Americans

were the second most common students comprising the sample (31.4%, n = 38). Only 12 students identified themselves as Asian, Hispanic, or Other making up the remaining 4.1%. Females comprised 92.6% (n = 112) of the sample population with males 7.4% (n = 9). Findings regarding the demographic data may be seen in Table 1.

Table 1

Demographic Characteristics of the Sample by Frequency and Percentage

Characteristic	f[a]	%[b]
Gender		
Female	112	92.6
Male	9	7.4
Race		
Caucasian	78	64.5
African American	38	31.4
Asian/Hispanic/Other	5	4.1
Age (years)		
17 to 21	78	64.5
22 to 30	43	35.5

[a]N = 121.

[b]Percentages were rounded to the nearest tenth place.

Results of Data Analysis

The research question for the study was as follows: What are the modifiable risk factors in the college population that contribute to an increased risk for osteoporosis? The study participants completed an Osteoporosis Lifestyle Survey which included demographic information. The survey consisted of 13 questions. Data were subjected to descriptive statistical analysis to determine frequency and percentage of each risk factor.

The variables evaluated were calcium consumption from milk, yogurt, ice cream, and cheese sources. Vegetables with a high-calcium content were also evaluated as a supplement to the more direct sources of calcium. Exercise frequency and type, lack of menses due to excessive exercise, alcohol use, smoking patterns, use of selected medications, vitamins, and calcium supplements were reported. The last three questions evaluated perceptions of activity level and the risk of osteoporosis.

Qualitative information was reported by using central theme tendency regarding the participant's knowledge of osteoporosis. Reasons for not exercising and explanations for their perception of risk for osteoporosis were also evaluated for central themes.

A broad estimate of daily calcium consumption was assessed. Each student reported a daily intake of food in

three categories. These categories were milk, yogurt that included ice cream and cheese, and vegetables (e.g., broccoli, collard greens, and spinach). For the purpose of this summary, the three categories were listed as milk, yogurt, and vegetables.

Only 18 students (14.8%) reached the recommended goal of greater than four servings of dietary calcium a day. Milk alone was not reported as often as the yogurt category. Most students combined servings from the milk and yogurt categories to meet the RDA standard of four servings of calcium-rich products per day. Even with combining sources of calcium, the majority of students reported an inadequate amount of daily calcium in their diet (see Table 2).

Table 2

Calcium Consumption of Students by Frequency and Percentage

Calcium	Servings/day	f[a]	%[b]
Milk	0	37	30.6
	1 to 2	78	64.5
	3 or more	6	5.0
Yogurt	0	22	18.2
	1 to 2	87	71.9
	3 or more	12	9.9

Note. Yogurt category includes servings of ice cream and cheese.
[a]N = 121.
[b]Percentages were rounded to the nearest tenth place.

The data from the survey indicated that the consumption of calcium-rich vegetables was not enough to be considered a high source of dietary calcium. Greater than four servings a day is the recommended amount of intake for calcium. Table 3 shows that eight students or 6.6% (n = 212) reported eating four or more servings of green leafy vegetables, such as broccoli, collard greens, and spinach daily.

Table 3

Students' Daily Consumption of Dark Green Leafy Vegetables by Frequency and Percentage

Food category	Servings/day	f[a]	%[b]
Dark green leafy vegetables	0	26	21.5
	1 to 2	67	55.4
	3	20	16.5
	4 or more	8	6.6

[a]N = 121.

[b]Percentages were rounded to the nearest tenth place.

Alcohol consumption was declared to be two or more servings a week by 14 students (11.6%), the majority of students (n = 89, 73.6%) stated they did not drink any alcohol on a weekly basis (see Table 4).

Table 4

Students' Weekly Consumption of Alcohol by Frequency and Percentage

Variable	Servings/day	f[a]	%[b]
Alcohol	0	89	73.6
	1	18	14.9
	2	6	5.0
	3	8	6.6

[a]N = 121.

[b]Percentages were rounded to the nearest tenth place.

Exercise on a regular basis was reported by 74.4% (n = 90) of the participants. The most common form of exercise was walking followed by a weight-training program. Table 5 gives the rank order of weight-bearing exercises.

Table 5

Reported Frequency of Exercise and Types of Exercise of Students by Frequency and Percentage

Variable	f[a]	%[b]
Exercise		
Yes	90	74.4
No	31	25.6

(table continues)

Table 5 (continued)

Variable	f[a]	%[b]
Types of exercise		
Walking	69	57.0
Weight training	44	36.4
Other	29	24.0
Jogging	28	23.1
Stair climbing	27	22.3
Basketball	13	10.7
Treadmill	5	4.1
Tennis	3	2.5

Note. Other = Aerobics, kickboxing, volleyball, soccer, and taebo.

[a]N = 121.

[b]Percentages were rounded to the nearest tenth place.

The students who stated they did not exercise were asked to explain their answer. There were two recurrent themes, "Lack of time" (n = 16) was the most common excuse with "Laziness" (n = 8) as the second theme.

Menses missed for longer than 6 months due to excessive exercise was reported by 4 students. Six students stated they had missed a menstrual cycle for 3 months or less. Nine males were eliminated from the data as illustrated in Table 6.

Table 6

Missed Menses of Students Due to Over Exercise by Frequency and Percentage

Variable	f[a]	%[b]
Missed menses		
Yes	10	8.3
No	102	84.3
N/A	9	7.4
No. of months missed[c]		
< 3	6	60.0
6 to 9	4	40.0

Note. N/A = not applicable.

[a]N = 121.

[b]Percentages were rounded to the nearest tenth place.

Reported student smoking was in the minority with only 14 students reporting cigarette use. The students smoked less than one half pack of cigarettes a day for less than 2 years. Table 7 reports the frequency of smoking.

Table 7

Smoking Frequency Reported by Students by Frequency and Percentage

Variable	f[a]	%[b]
Smoking		
Yes	14	11.6
No	107	88.4

[a]N = 121.
[b]Percentages were rounded to the nearest tenth place.

Multivitamins were used by 65.3% of the students. Table 8 demonstrates that the majority of students did not use calcium supplements. Only 2 students reported using other long-term medications, specifically steroids and seizure medications.

Table 8

Frequency of Use of Vitamins, Calcium Supplements, and Medications of Students by Frequency and Percentage

Variable	f[a]	%[b]
Multivitamin		
Yes	42	34.7
No	79	65.3

(table continues)

Table 8 (continued)

Variable	f[a]	%[b]
Calcium supplement		
Yes	12	9.9
No	109	90.1
Medications		
Yes[c]	2	1.7
No	119	98.3

[a]N = 121.
[b]Percentages were rounded to the nearest tenth place.
[c]Seizure medications and steroids.

When the students were questioned regarding their perception of being a "couch potato," 20 students responded yes and 101 responded no. The 8 students who responded positively to being a couch potato also reported exercising on a regular basis.

Table 9 notes that approximately one fourth of the student responders thought they were at risk for osteoporosis. Another fourth of the students did not know if they were at risk for osteoporosis. The rest of the students reported that they had no risk of osteoporosis.

Table 9

Students' Reported Perception of Being at Risk for Osteoporosis by Frequency and Percentage

Variable	f[a]	%[b]
Risk		
Yes	34	28.1
No	54	44.6
Don't know	33	27.3

[a]N = 121.
[b]Percentages were rounded to the nearest tenth place.

The only significant findings between the two age groups, 17 to 21 years and 22 to 30 years, were in milk consumption and the type of sport participated in by the students. The older group consumed more milk ($t = 0.013$, $p < .05$) and played more tennis ($t = 0.018$, $p < .05$).

The last two questions asked the student to explain their answer regarding their risk of osteoporosis and what they knew about osteoporosis. The students more frequently reported that they were at risk for osteoporosis because of a lack of dairy products in their diet ($n = 22$). A positive family history ($n = 10$) and being a female ($n = 8$) were the next most frequent statements regarding why they thought they were at risk.

Those who did not consider themselves at risk for osteoporosis explained that it was because they were "healthy" (n = 10), they consumed enough calcium (n = 5), and they exercised (n = 5). Several students (n = 7) reported that they did not know if they were at risk simply because they "never thought about it."

When asked what they knew about osteoporosis, the students most often used the word "deterioration" to describe the disease. "Weak," "frail," and "brittle" were used to describe the effect of the disease on bones (n = 41). Another group of students identified that a person is at risk if he or she does not consume enough calcium, vitamins, or minerals (n = 22). Gender and age were frequently mentioned. Women were identified at greater risk than men (n = 19), with 8 students reporting that women over 40 years of age were at greater risk than younger women. Hormone replacement therapy after menopause and exercise for prevention were also identified (n = 8).

Misinformation about osteoporosis was identified with statements, such as "You have weak teeth," it is "arthritis and joint problems," "Osteo what?" and "Anyone over 30 can get it." Fourteen students admitted to knowing "nothing," and 15 students stated that they did not "know much" about the disease. Overall, the information was correct although

limited to a vague idea of a disease that affects older women and their bones.

Chapter V

The Outcomes

The purpose of this study was to identify the modifiable risk factors for osteoporosis that the college-age population is participating in that may increase their risk for the disease. The design was nonexperimental descriptive. Data were obtained by administering the Osteoporosis Lifestyle Survey to a random sample of the college population at a small southern university.

Chapter V focuses on the outcome of the data analysis of the results. The meaning of the results and a discussion of these findings in light of the previous literature reviewed will be presented. Implications for nursing in the area of education, prevention, research, and theory will be explored. Limitations of the study and recommendations for future studies will be presented.

Discussion

The college population represents the age when optimal bone mass is likely to peak. Lifestyle choices made at this time have long-term consequences and habits

formed may be retained. Therefore, risk factors for osteoporosis in this population have a special relevance (Leslie & St. Pierre, 1999).

The sample in this study consisted of 121 randomly selected college students between the ages of 17 and 30 years. The average age was 21.7 years; 92.6% of the sample were female. This was not unexpected because the selected school is a predominantly female university.

Comparisons were made between students ages 17 to 21 years and students ages 22 to 30 years. The only significant finding was the older age group consumed more milk and exercise consisted of playing tennis. A trend was noted that the older students reported consuming more calcium supplements than did the younger students. Although the older students did have an increased milk consumption and calcium supplementation, it was still below the RDA recommendations for daily calcium consumption. Higher milk consumption and calcium supplementation may be a result of knowledge that both afford a healthier lifestyle. Recent advertising has undoubtedly positively influenced health choices of calcium supplements. One explanation for the older students supplementing their diet with calcium tablets was marketing strategies. Vitamins and other supplemental sources tend to be promoted toward the older individual.

In this study the researcher documented that students in the sample age groups did not consume enough calcium. This outcome was supported in the review of literature (Jones-Watson, 1994; Leslie & St. Pierre, 1999).

The current research did not agree with the conclusions that Taggart and Connor (1995) reported in their study. They indicated that older students had more barriers to exercise, thereby limiting their frequency and knowledge of osteoporosis, and susceptibility to personal risk was higher than younger students. This was in direct opposition to the conclusions of the current study. The current study failed to demonstrate a statistically significant difference in older students' frequency of exercise or their perception of personal risk of osteoporosis when compared with the younger age group. It was interesting to note that 30.3% of the older students and 36.8% of the younger students reported not exercising. Lack of exercise can indicate a lack of knowledge concerning the importance of exercise in relation to bone mineral density. This result was reported to be from the pressures of college and the time constraints inherently found in the educational system.

The researchers in the literature frequently reported recommendations regarding exercising and the effect physical activity has on stimulating bone growth in the

immature skeleton and preserving and maintaining skeletal mass in later years (Licata, 1999). A systematic review of randomized clinical trials of women and exercise strongly suggested that regular physical exercise has an effect on bone mineral density and can reduce the risk of osteoporosis (Ernst, 1998). Regular exercise continues to be recommended for men and women across the life span to maximize bone mass and reduce age-related bone loss (Dook et al., 1997; Rutherford, 1999; Sedlak et al., 2000). Exercise also affects muscle balance and strength which helps prevent osteoporotic fractures associated with falls.

Bone mass accumulation peaks from age 25 to 30 years. Lifelong protection is enhanced if bone density is at an optimum level. Calcium consumption has a direct relationship to bone mineral density during the formative years (Teegarten et al., 1999). The current study sought to identify the amount of calcium consumption in the sample population. The results revealed that only 14.8% of the students consumed an adequate amount of calcium a day. This finding is consistent with low dietary calcium intake found in several studies (Lloyd et al., 2000; Lysen & Walker, 1997). Students with low calcium consumption and lack of exercise are placing themselves at risk for future consequences of low bone mineral density.

The most serious outcome of low bone mineral density and the resultant osteoporosis is fractures. Hip fracture occurrence is somewhat predictable when measuring bone density and evaluating the age of the patient. Advancing age and reduced bone mineral density are current indicators of fracture risk (Turner, Faile, & Tomlinson, 1999). High peak bone mass reduces the risk of fractures in later years. Therefore, students in this study are at a high risk for future fracture. Their lack of calcium intake and exercise needs to improve to reduce their risk for osteoporosis and potential fracture.

Dietary calcium did not provide an adequate amount of daily calcium. Students most often combined sources of dairy products to obtain the calcium they did consume. This implies that a variety of sources need to be available to enhance the likelihood that adequate calcium will be consumed. Only a minority of students (9%) reported using milk as their only source of calcium. This indicates that increasing milk alone may not influence adequate calcium intake. The marketing campaign of "Got Milk?" may need to expand to "Got Yogurt, Too?" in order to influence a true increase in calcium consumption among the college population. Researchers indicate that adolescents and young adults who understand the connection between calcium consumption and strong bones have a better

chance of osteoporosis prevention (National Osteoporosis Foundation, 1998).

Vegetables are a minor source of calcium and add to the diet in a supplemental fashion. A large volume of vegetables must be consumed if they are to be considered a primary source of calcium. It has been hypothesized that a diet high in fruits and vegetables may result in a better balance of minerals and vitamins in the blood. Therefore, better bone health with the release of minerals in the system may occur. A positive correlation between bone-mineral density and high-fruit and vegetable consumption was seen in the Framingham Heart study (Nelson, 2000). The current study revealed that 93.4% of the students indicated that they ate less than three servings of dark green leafy vegetables a day. This consumption is an inadequate amount to be considered a main source of dietary calcium. It may be because few vegetables rich in calcium are available in a convenient form for the active college student.

This researcher revealed that most students did not consume alcohol on a weekly basis. This general report on the risk factor of alcohol use indicated that further investigation should be conducted to evaluate the depth of alcohol use in the 26.5% of the students reporting drinking on a regular basis. One male and 7 females

admitted to three or more alcohol servings in a week's time. The extent of under-reporting and over-reporting of this behavior cannot be determined in this study. Possible reporting discrepancies are not uncommon as noted in the reporting of alcohol use in the Centers for Disease Control and Prevention (CDC), Youth Risk Behavior Surveillance (Kann et al., 2000) and Social Norms Research in College Health (Keeling, 2000).

In general, the results for alcohol use in females in the current study were higher than those cited by the U.S. Preventive Services Task Force. The researchers reported the prevalence of alcohol use and dependence among 18- to 29-year-olds was from 4% to 10% in women (U.S. Preventive Services Task Force, 1996). The rates of 17% to 24% in men were reported by the task force, but the present study rate for men was only 1%. This may be due to the small sample size. Self-reporting with one question is not a precise evaluation of the risks associated with alcohol use and may be inadequate to compare nationally. One or more alcoholic beverages a week may not necessarily indicate alcohol dependence or abuse. This author recommends that alcohol consumption questions in this study tool should be refined to be more specific. The risk factor of regular alcohol use should be addressed for any population for general health reasons, but the college

population needs strategies to promote behaviors that contribute to osteoporosis risk reduction while bone mass is accumulating. Better or healthier decisions during young adulthood have a significant influence on tomorrow's well-being (Keeling, 2000).

Exercise is another behavior that is known to have far-reaching influence on future health. This study revealed that a majority of students were participating in regular weight-bearing activities. The goal of risk identification was to focus on the individuals who did not meet the recommended standards of exercise. It was interesting to note that the inactive students gave several reasons for their lack of exercise. These reasons were not because they did not like to exercise or they were physically challenged, but "a lack of time" and "laziness." In keeping with Pender's Health Promotion Model, the researcher suggests that new approaches need to be devised to destroy the barriers of time and motivation to achieve the goal of regular exercise for the entire student population.

Excessive exercise and the resultant amenorrhea can lead to devastating changes in bone health (Hobart & Smucker, 2000). This combination was identified as a risk factor by 8.3% of the students. Hobart and Smucker (2000) reported that the percentage of amenorrhea in the general

population is 2% to 5%. This researcher revealed a significant problem that needs to be further evaluated. Early detection and treatment should be in place in order for students to avoid the irreversible osteoporotic consequences of exercise-induced amenorrhea. Eating disorders often accompany this behavior. Students did not identify amenorrhea as being associated with osteoporosis in answering the qualitative questions about knowledge or risk in this study.

College health personnel and family physicians are gaining in their understanding of exercise-induced amenorrhea (Hobart & Smucker, 2000). Education in the general college population can increase awareness of this risk factor and serve to identify persons at risk. Early identification and treatment is necessary to prevent lifelong consequences of osteoporosis in college students.

Excessive exercise has specific risks for osteoporosis, just as inactivity can contribute to a lack of bone mass density accumulation (Ernst, 1998; Maharam et al., 1999). The population participating in this survey did routinely participate in exercise. The most common form of exercise for all participants was walking. Not surprisingly, more males participated in treadmill, basketball, and weight training. This information should be correlated to see if this selected university has

walking tracks or indoor walking facilities available that encourage this behavior. Instructional courses, such as aerobics, taebo, and kickboxing, were high on the list of weight-bearing exercises in which students participated. Group activities should be studied for this population to continue participation for a reduction in lack of exercise as a risk factor.

The only significant difference between the two genders in this study was the type of exercise in which the males participated. Treadmill, weight training, and basketball were the exercises males reported most frequently. This information was not unexpected, and the practical implications of this finding will help future education and research of men to focus on the reported choice of weight-bearing exercise.

Smoking as a risk factor was not reported by the students in a large part of the sample. A possible explanation for the results of this survey may be due to the general public health awareness of the dangers of smoking. The university selected in this study is a smoke-free environment and has designated outdoor areas for smokers. Students did not report any connection between smoking and osteoporosis when asked what they knew about osteoporosis, nor was smoking mentioned as an explanation for risk of the disease. This leads the author to conclude

that the students may not be aware of the possible connection of smoking to bone health (Leslie & St. Pierre, 1999; Morabia et al., 2000).

Personal risk for osteoporosis and knowledge of the disease were evaluated qualitatively. Findings of this research were consistent with the findings by Sedlak et al. (1998), Sedlak et al. (2000), and Taggart and Connor (1995) because participants had a low level of understanding of the disease process and the risk factors for osteoporosis.

Conclusions

Based on this study, the following conclusions were drawn. The main modifiable factor that increases the risk for osteoporosis in the college-age population is inadequate calcium intake. Unfortunately, this one risk factor can have irreversible lifelong consequences if optimum bone mineral density is not achieved by age 30 years. The majority of students reported that they did not smoke, therefore reducing this as a risk in the sample population. The students reported adequate participation in the modifiable risk factor of exercise; however, this could be improved even further to decrease the risk of inactivity leading to osteoporosis. Amenorrhea due to excessive exercising was reported at a higher rate in this

study when compared with published data in the general population (Hobart & Smucker, 2000). The resultant osteoporosis can be devastating and interventions on all levels of college health need to address this potential problem. In this study few students reported consuming alcohol on a weekly basis, but this aspect of college health should be further evaluated with specific tools that evaluate all aspects of this risk factor.

Additionally, this study had another important finding. Based on the qualitative questions relating to the students' risk and knowledge regarding osteoporosis, they were not very knowledgeable about the disease, their own risk, or the need for prevention. Pender's Health Promotion Model was an appropriate choice for the framework to investigate what activities college students are participating in that may prevent the serious consequences of osteoporosis. Pender encourages individuals to be aware of their personal risk of developing disease, the seriousness of the consequences of the disease, and preventive actions to promote health. Modifiable risk factor identification is a step toward health promotion. Identification of risk factors that reduce the chance of osteoporotic complications should be made known to the public. The college population, as evidenced in this research, needs to have a greater

understanding of the necessity to participate in preventive measures. Encouragement and education of the benefits of positive lifestyle choices along with the identification of perceived barriers to preventive action are essential to the young adult population. Nurse practitioners should assist the student in establishing good lifestyle choices. The habits being formed now can influence the student for their lifetime.

Implications for Nursing

This research is significant to nursing in the area of practice, research, education, and theory. The findings of the research may have an influence on the nurse practitioner's practice. Understanding the risk factors for osteoporosis that are modifiable and identifying persons who need to modify their behavior to reduce the consequences of this disease are essential. The sample in this study consisted of college men and women ages 17 to 30 years. Because the sample size was modest, limited implications can be drawn. Assessing the patient for modifiable risk factors, particularly lack of calcium intake and exercise habits, is appropriate at any stage of life.

Genetic factors, such as race and gender, play a large role in the development of osteoporosis and are

considered non-modifiable risk factors. These factors cannot be altered, but a change in the severity of the disease may be affected by controlling known modifiable risk factors. Enhancing the body's natural tendency toward health and providing the best foundation before the natural progression of the disease occurs are goals of prevention. Identification of risk factors that can be modified and the participation in lifestyle choices that minimize the risk are the desired outcomes of this research process.

Nurse practitioners may apply the findings of this study in assisting patients to identify their own personal risk. The nurse practitioner can assist patients in developing strategies to alter the risks that can be changed, not only for the prevention of osteoporosis but for their general health. The nurse practitioner's role in primary care is to encourage the patient in simple as well as complex ways to reach his or her health goals. Basic education regarding sources of calcium, such as enriched juices, eating yogurt, and cereals fortified with calcium, can be mentioned at any patient encounter. Assisting the patient to evaluate his or her level of risk, then planning ways to reduce the risks he or she can modify may take a more planned encounter. Once the nurse practitioner is familiar with the risks, he or she needs to encourage

modification of behaviors early in the patient's life. The goal of maximizing bone mineral density before age 30 is essential to prevent lifelong consequences of osteoporosis. The role of the nurse practitioner in assisting the younger patient on methods to build bone mass before depletion begins is consistent with preventive medicine. Once menopause occurs, the practitioners needs to help the patient maintain bone mass. Dealing with the disease and the consequences is part of the practitioner's role as well as prevention.

The results of this study may be applied in education by providing nursing schools with this information. Not only do students in schools of nursing need the information in regard to osteoporosis education for their future patients, but also to be an example of good health. Incorporating more information into nursing school curricula will help the nurse begin to assess all patients for modifiable risk factors for osteoporosis. For nursing students, the knowledge that information is imperative for the patient to avoid long-term consequences of poor bone mineral density is important. Prevention and patient education are key roles in nursing. Providing information of the risk factors for osteoporosis at the basic nursing level will promote understanding that will eventually filter to the patient.

Nurse practitioner students have expanded the role of broad-based preventive skills. The modifiable risk factors for osteoporosis identified in this study have implications in multiple areas of health promotion. General knowledge regarding the disease process of osteoporosis and specific risk factors will help the nurse practitioner care for patients in any stage of life. Knowledge of assessment tools available, such as bone mineral density scans and screening surveys, should be in the nurse practitioner's educational training. When disseminated, the outcomes of this study may improve patient care.

This research adds to the current body of nursing knowledge. More research is needed to focus on one modifiable risk factor and explore all aspects of that risk in the sample population. The next step is the evaluation of specific measures that would promote lifestyle changes and assist the patient in significant modification of his or her risk. This study was designed to assess the broad participation of possible risk factors in the college population. The study revealed the most frequent modifiable risk factors at a small southern university. The author suggests that a strategy to focus on behavioral changes is necessary. Nursing should further research each identified risk factor. Inadequate calcium

consumption, amenorrhea due to excessive exercise, and lack of sufficient exercise were the main areas of concern for this sample population.

Health promotion should stem from a logical evaluation of a problem; this study was the first step. Included in further research should be the participants' knowledge and perceptions about the lack of their participation in health-promoting activities. As Pender (1996) suggests, the identification of barriers and benefits to modifying risks should also be examined. Prevention of osteoporosis, evaluation and identification of people at risk, and then assisting them to achieve optimal health are outcomes of research, education, and health promotion.

Limitations

The design of the study imposed certain constraints upon the generalization of the findings. The study was conducted in a small predominantly female university; therefore, a gender limitation may have skewed the gender comparison. No attempt to analyze the subgroups of males and Asians was made because the size of the subgroups was small. A longer time period for data collection could have increased the sample size, thereby increasing the validity of the results. The survey was limited because the

validity and reliability of the survey tool were not established. The recommendation of this author is to refine the instrument for both clarity and ease of administration.

Recommendations for Further Study

Based on the findings of this study, the following recommendations are made for future research in nursing:

1. Replication of this study using a larger, more diverse sample.

2. Conduction of a comparative study to survey persons of the same age range but not in college.

3. Conduction of a study that focuses on the modifiable risk factor of inadequate dietary calcium using a more specific food questionnaire.

4. Conduction of a study to determine bone mineral density in the college population in relation to participation in modifiable risk factors.

5. Development of valid and reliable research instruments that can evaluate risk factors in the college population.

6. Research to evaluate sources of dietary calcium available to the college population, their level of consumption, and knowledge and beliefs regarding consumption and risk for osteoporosis.

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APPENDIX A

OSTEOPOROSIS LIFESTYLE SURVEY

Osteoporosis Lifestyle Survey

Put a check (✔) in the space that most closely resembles your current lifestyle.

1. You are
   ❒ a. Female ❒ b. Male

2. You are
   ❒ a. White
   ❒ b. African American
   ❒ c. Asian
   ❒ d. Hispanic
   ❒ e. Other

3. Your age is ___ years.

4. On an average day, how many servings do you have of?
   a. Milk(6-8 oz. serving size)
      ❒ 0 ❒ 1-2 ❒ 3 or more

   b. Yogurt, ice cream, or cheese
      ❒ 0 ❒ 1-2 ❒ 3 or more

   c. Dark green leafy vegetables (i.e., broccoli, collard greens, spinach)
      ❒ 0 ❒ 1-2 ❒ 3 ❒ 4 or more

5. How many alcoholic beverages do you consume in a **week**?
   ❒ a. 0
   ❒ b. 1
   ❒ c. 2
   ❒ d. Over 2

6. Do you engage in regular weight-bearing exercise programs?
   ❒ a. Yes ❒ b. No

   If yes, how many times a week? (Place # beside sport)
   _____ a. Jogging
   _____ b. Walking
   _____ c. Treadmill
   _____ d. Stair-climbing
   _____ e. Weight training
   _____ f. Tennis
   _____ g. Basketball
   _____ h. Other. Please specify:_____

   If no, why not?

***If male, skip to question #8.**

7. Have you missed or had an irregular menstrual period due to over-exercising?
   ❒ a. Yes How many months?_____
   ❒ b. No

8. Do you smoke cigarettes?
   ❒ a. No ❒ b. Yes

   How long have you been smoking?_____

   Number of packs a day?_____

9. Do you take a multivitamin?
   ❒ a. Yes ❒ b. No

10. Do you take a calcium supplement?
    ❒ a. Yes ❒ b. No

11. Do you take any long-term medications, such as
    a. Antiseizure medications (i.e., Dilantin, Tegretol)
       ❒ No ❒ Yes
    b. Thyroid medications (i.e., Synthyroid)
       ❒ No ❒ Yes
    c. Steroids (i.e., Prednisone)
       ❒ No ❒ Yes

12. Do you consider yourself a couch potato?
    ❒ a. Yes ❒ b. No

13. Do you consider yourself at risk for osteoporosis?
    ❒ a. Don't know
    ❒ b. Yes
    ❒ c. No

    Would you explain your answer?

14. What do you know about osteoporosis?

Thanks for your participation!

APPENDIX B

APPROVAL OF MISSISSIPPI UNIVERSITY FOR WOMEN'S COMMITTEE ON USE OF HUMAN SUBJECTS IN EXPERIMENTATION

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February 23, 2001

Ms. Sally H. Pearson
c/o Division of Nursing
P. O. Box W-910
Campus

Dear Ms. Pearson:

I am pleased to inform you that the members of the Committee on Human Subjects in Experimentation have approved your proposed research as submitted. The committee recommended that you take steps to ensure confidentiality, such as encryption concerning any information transmitted over the internet.

I wish you much success in your research.

Sincerely,

Vagn K. Hansen, Ph.D.
Vice President
for Academic Affairs

VH:wr

cc: Mr. Jim Davidson
Dr. Patsy Smyth